



Development of an On-Line, Real-Time Alpha Radiation Measuring Instrument for Liquid



Developer: Thermo Power Corp. (Tecogen Division)

Contract Number: DE-AR21-95MC32088

Crosscutting Area: CMST

Subsurface
Contaminants
FOCUS AREA

Problem:

The Department of Energy must ensure that effluent waters leaving contaminated DOE sites do not affect the public's safety or health. Alpha-emitting radioisotopes, such as U238/U234 and Pu239, are rated by the U.S. EPA as class A carcinogens with very low regulated limits in water. Uranium also has a high chemical toxicity. The EPA proposed maximum concentration limit for uranium in public drinking water supplies is 20 ppb (30 pCi/l), equivalent to an emission of 58 alphas per minute in 1 liter of water. For reference, the world's sea water has a uniform uranium concentration of 3.3 ppb.

Currently, surface and ground waters at contaminated DOE sites are monitored for alpha emitters (and other contaminants) by intermittent sampling, with analysis at a central laboratory. Principal shortcomings of the current approach are that it: does not capture every spike in radionuclide levels, has high end-to-end total costs, has a long time delay between sampling and data availability, is

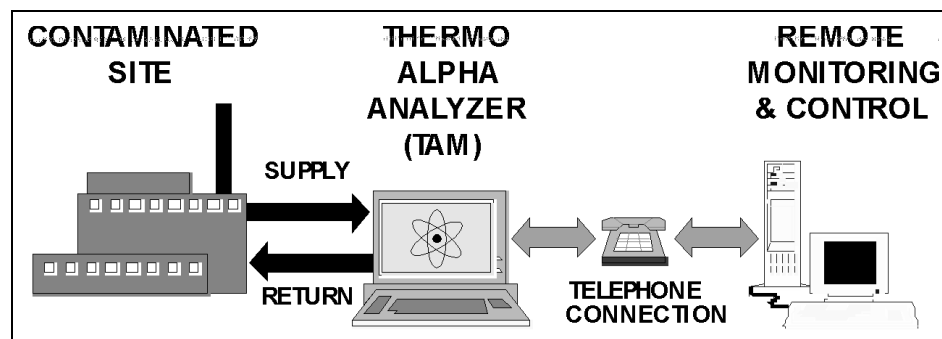
prone to errors and mistakes due to the multiple handling and manual processing steps involved, and requires awkward and expensive archiving of samples.

Solution:

Under DOE contract, Thermo Power Corporation has demonstrated a new technology which permits extremely sensitive counting of alpha emitters in water, providing high-resolution alpha spectrometry. Individual radionuclides can be assayed simultaneously, based on their different alpha energies. This new technology provides the basis for an on-line, real-time monitor of alpha-emitting radionuclides, both for effluent streams leaving DOE sites and for process streams.

Benefits:

- ▶ No delay in obtaining accurate analyses.
- ▶ Dramatic reduction in end-to-end alpha monitoring costs.
- ▶ Readily and conveniently archived samples.
- ▶ Isotopic analyses, allowing discrimination of naturally-occurring radionuclides (radon daughters).
- ▶ Analyzing waste and process water (NPDES) discharges.
- ▶ Surface and ground water monitoring, with future extension to solid samples, non-aqueous liquids, gas streams, and solid surfaces.



Technology:

The technology involves a patent-pending, in situ method of collecting and concentrating dissolved radioactive species on a solid surface, allowing for rapid quantification of the specific alpha-emitting species with a solid-state silicon detector. Initial development of this technique involved simultaneous collection and quantification of the radioisotopes directly on the silicon detector, providing an energy resolution equivalent to conventional electroplating techniques. This technology has been proven with laboratory and field tests, with both naturally-occurring and transuranic alpha emitters.

Alternative implementations of this technology are being developed, in order to extend the detection limits well below the existing picoCurie per liter range, improving the response time of the technique, and providing an archival record of the analyzed sample.

Contacts:

Thermo Power Corporation's corporate mission is to develop and

market innovative technological products and services to government and private sector customers. For information on this project, the contractor contact is:

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DOE's Morgantown Energy Technology Center supports the Environmental Management - Office of Science and Technology by contracting the research and development of new technologies for waste site characterization and cleanup. For information regarding this project, the DOE contact is:

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